One of our special factoring patterns is the ***sum of cubes***. We can use this when we have two perfect cube terms with a + sign between them.

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

Example 1

Factor $w^3 + 216$

The cube root of 216 is 6, so we could rewrite this as $w^3 + 6^3$.

$$w^3 + 216$$
$$(w)^3 + (6)^3$$

It is OK to do this step in your head

$$(w + 6)(w^2 - w(6) + (6)^2)$$

$$\boldsymbol{(w + 6)(w^2 - 6w + 36)}$$

One of our special factoring patterns is the ***difference of cubes***. We can use this when we have two perfect cube terms with a $-$ sign between them.

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

Example 2

Factor $c^3 - 1000$

The cube root of 1000 is 10, so we could rewrite this as $c^3 - 10^3$.

$$c^3 - 1000$$

$$(c)^3 - (10)^3$$

It is OK to do this step in your head

$$(c - 10)(c^2 + c(10) + (10)^2)$$

$$\mathbf{(c - 10)(c^2 + 10c + 100)}$$

Remember to look for a greatest common factor first!

Example 3

Factor $2x^3 - 128$

The GCF is 2

$$2x^3 - 128$$
$$2(x^3 - 64)$$

The cube root of x^3 is x and the cube root of 64 is 4, so we could rewrite $x^3 - 64$ as $x^3 - 4^3$.

$$2(x^3 - 64)$$
$$2[(x)^3 - (4)^3]$$

It is OK to do this step in your head

$$2(x - 4)(x^2 + x(4) + (4)^2)$$

$$\boxed{\mathbf{2(x - 4)(x^2 + 4x + 16)}}$$